

Patent claims

1. A particle-optical arrangement, comprising:

5 a beam changing arrangement for acting on a plurality of beams of charged particles, and

a beam guiding arrangement for supplying the plurality of beams to the beam changing arrangement such that
10 they enter the beam changing arrangement offset from each other along a first direction,

wherein the beam changing arrangement comprises a comb lens having at least one row of a plurality of field
15 source members for providing a common spatial region with at least one of an electric field and a magnetic field, for acting on the beams entering the common field region, and wherein the row extending in the first direction.

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2. The particle-optical arrangement according to claim 1, wherein the field comprises in the common spatial region a quadrupole field which defocuses the beams in the first direction.

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3. The particle-optical arrangement according to claim 1, further comprising a focusing device for focusing the beams in the first direction.

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4. The particle-optical arrangement according to claim 3, wherein the focusing device generates for each beam a separate field comprising a quadrupole field.

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5. The particle-optical arrangement according to claim 1, wherein the beam guiding arrangement comprises at least one beam deflector for displacing positions

where the beams enter the beam changing arrangement in the first direction.

- 5 6. The particle-optical arrangement according to claim 5,
 wherein the beam deflector comprises a comb lens
 having at least one row of a plurality of field source
 members.
- 10 7. The particle-optical arrangement according to claim 5,
 wherein a main axis of the field generated in the
 common spatial region is displaceable in the first
 direction.
- 15 8. The particle-optical arrangement according to claim 1,
 wherein the electric field and magnetic field,
 respectively, each have a focusing effect on the
 beams.
- 20 9. The particle-optical arrangement according to claim 1,
 wherein the electric field and magnetic field,
 respectively, each have a beam-deflecting effect on
 the beams.
- 25 10. The particle-optical arrangement according to claim 1,
 wherein each field source member extends in a second
 direction oriented transversely to the first
 direction, and has a front face oriented towards a
 central axis of an aperture of the comb lens.
- 30 11. The particle-optical arrangement according to claim 1,
 further comprising a driver arrangement for
 controlling source strengths of the individual field
 source members.

12. The particle-optical arrangement according to claim 11, wherein the field source members are sources of electric fields and wherein the driver arrangement is configured to supply adjustable electric voltages to the field source members.
13. The particle-optical arrangement according to claim 11, wherein the field source members are sources of magnetic fields, and wherein the driver arrangement is configured to supply adjustable electric currents to plural windings allocated to the field source members.
14. The particle-optical arrangement according to claim 1, wherein a number of the field source members in each one of the rows is higher or equal to two times the number of the beams.
15. A particle-optical deflecting arrangement for deflecting at least one beam of charged particles, wherein the deflecting arrangement comprises:
- a comb lens having at least one row of a plurality of field source members, the row extending in the first direction, and
- a driver arrangement for controlling source strengths of the individual field source members such that at least a dipole field is generated in a field region passed by the beam, the dipole field deflecting the beam, wherein the field region with the beam-deflecting dipole field extends merely over a portion of a length of the row.

16. The particle-optical deflecting arrangement according to claim 15, wherein the driver arrangement is configured for controlling the source strengths of the individual field source members such that a round lens field for focusing the beam is generated in the field region, wherein the round lens field is superimposed with the dipole field.
17. The particle-optical deflecting arrangement according to claim 15, wherein the driver arrangement is configured for controlling the source strengths of the individual field source members such that a quadrupole field for focusing the beam in the first direction or/and transversely to the first direction is generated in the field region, wherein the quadrupole field is superimposed with the dipole field.
18. The particle-optical deflecting arrangement according to claim 15, wherein the driver arrangement is configured for controlling the source strengths of the individual field source members such that a field with a higher order than a quadrupole order is generated in the field region, wherein the field with the higher order than the quadrupole order is superimposed with the dipole field.
19. A particle-optical arrangement, comprising:
- a first beam guiding arrangement for focusing a plurality of probe beams of charged particles substantially in an object plane,
- a detector arrangement for detecting intensities of secondary particles,

a second beam guiding arrangement for guiding the secondary particles emanating from a region about the object plane as secondary beams to the detector arrangement,

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wherein the detector arrangement comprises a position-sensitive detector having a plurality of detector elements, wherein at least one of the secondary beams is guided to plural detector elements.

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20. The particle-optical arrangement according to claim 19, wherein the detector arrangement is configured such that a secondary particle intensity corresponding to each of the probe beams is detectable.

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21. The particle-optical arrangement according to claim 19, wherein the detector arrangement comprises a controller configured to combine intensities detected by detector elements in regions of the detector allocated to a respective probe beam and to output the combined intensities as the secondary particle intensities.

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22. The particle-optical arrangement according to claim 19, wherein the beam changing apparatus comprises at least one beam deflector for displacing positions where the probe beams are focused in the object plane.

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23. The particle-optical arrangement according to claim 22, wherein the controller is configured to change the regions of the detector dependent upon the displacement of the positions where the probe beams are focused in the object plane.

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24. The particle-optical arrangement according to claim 19, wherein the detector arrangement comprises at least one aperture for the probe beam to pass through.

5 25. The particle-optical arrangement according to claim 19, wherein the beam guiding arrangement comprises at least one beam separator for separating the beam path of the probe beams and the beam path of the secondary beams from each other.

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26. A particle-optical arrangement, comprising:

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a first beam guiding arrangement for focusing a plurality of probe beams of charged particles substantially in an object plane,

a detector arrangement for detecting intensities of secondary particles, and

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a second beam guiding arrangement for guiding the secondary particles emanating from a region about the object plane as secondary beams to the detector arrangement,

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wherein the second beam guiding arrangement comprises an objective arrangement for focusing the probe beams in the object plane, wherein the secondary beams pass through the objective arrangement,

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wherein the second beam guiding arrangement comprises at least one beam deflector (75, 77), wherein the secondary beams pass through the beam deflector.

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and wherein the beam deflector and the objective arrangement are integrally formed in that they

comprise at least one common comb lens having at least one row of a plurality of field source members.

5 27. The particle-optical arrangement according to claim 26, wherein the first beam guiding arrangement comprises a collimating arrangement for collimating the probe beams.

10 28. The particle-optical arrangement according to claim 26, wherein the first beam guiding arrangement comprises at least one beam deflector, and wherein the beam deflector and the collimating arrangement are integrally formed in that they comprise at least one
15 comb lens having at least one row of a plurality of field source members.

29. A particle-optical arrangement, comprising:

20 a beam changing arrangement for acting on a plurality of beams of charged particles, and

a beam guiding arrangement for supplying the plurality of beams to the beam changing arrangement such that they enter the beam changing arrangement along
25 predetermined beam axes as separate beams spaced apart from each other,

30 wherein the beam changing arrangement comprises a comb lens having at least one row of a plurality of field source members for providing for each beam a separate spatial region with at least one of an electric field and a magnetic field, for acting on the beam entering the respective region.

30. The particle-optical arrangement according to claim 29, wherein the beam guiding arrangement comprises a beam source arrangement with a plurality of beam sources, wherein each one of the beam sources
5 generates one of the beams of charged particles, and wherein beam source arrangement comprises a row of plural aperture stops which are fixedly disposed with respect to the beam changing arrangement.
- 10 31. A beam guiding arrangement for providing a beam path for at least one beam of charged particles, the arrangement comprising:
- a beam source arrangement with at least one beam
15 source for generating the at least one beam of charged particles,
- a first particle-optical deflecting arrangement according to one of claims 15 to 18 for collimating
20 the beam generated by the beam source arrangement and for deflecting the same at an adjustable first angle,
- a second particle-optical deflecting arrangement according to one of claims 15 to 18 for focusing the
25 beam collimated by the first beam changing arrangement and for deflecting the same at an adjustable second angle.
32. The beam guiding arrangement according to claim 31,
30 wherein the beam path between the first and second beam changing arrangements is a telescopic beam path.
33. A microscopy system for inspecting an object,
35 comprising a particle-optical arrangement according to one of claims 1 to 32.

34. A lithography system for transferring a pattern onto a particle-sensitive substrate with at least one writing beam of charged particles, the system comprising a particle-optical arrangement according to one of
5 claims 1 to 32.
35. A lithographic method for transferring a pattern onto a particle-sensitive substrate with at least one writing beam, wherein secondary electrons released
10 from the substrate by the writing beam are detected.
36. The lithographic process according to claim 35, wherein the pattern is transferred to the particle-sensitive substrate with a plurality of writing beams,
15 and wherein a secondary electron intensity corresponding to each one of the writing beams is detected.